

**IN THE CLAIMS**

- 1 1. (previously presented) An apparatus for determining a property of a fluid  
2 downhole comprising:  
3 (a) a resonator in contact with the fluid downhole;  
4 (b) a controller that actuates the resonator; and  
5 (c) a processor that estimates the property of the fluid using a response of the  
6 resonator to the actuation.  
7
- 1 2. (previously presented) The apparatus of claim 1, wherein the processor uses a  
2 chemometric equation for estimating the property.  
3
- 1 3. canceled  
2
- 1 4. (previously presented) The apparatus of claim 2 wherein the processor correlates a  
2 measured resonator response with known fluid property values.  
3
- 1 5. (previously presented) The apparatus of claim 1, wherein the property is viscosity.  
2
- 1 6. (previously presented) The apparatus of claim 1, wherein the property is density.  
2
- 1 7. (previously presented) The apparatus of claim 1, wherein the property is dielectric  
2 constant.

3

1 8. (previously presented) The apparatus of claim 1, wherein the property is  
2 resistivity.

3

1 9. (previously presented) The apparatus of claim 2, wherein the processor applies  
2 the chemometric estimated property to a Levenberg-Marquardt (LM) algorithm to  
3 determine a fluid parameter value for the fluid.

4

1 10. (original) The downhole tool of claim 10, wherein the fluid parameter value  
2 comprises a global minimum for the LM algorithm.

3

1 11. (currently amended) A method for determining a property of a fluid downhole,  
2 the method comprising:

- 3 (a) positioning a resonator adjacent to the downhole fluid;  
4 (b) actuating the resonator;  
5 (c) measuring a response of the resonator to the actuation; and  
6 (d) estimating a value of the property of the fluid downhole based on the  
7 measured response while the fluid is one of (i) being pumped, and (ii)  
8 static.

9

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1 12. (previously presented) The method of claim 11, further comprising:  
2 estimating the fluid property using a chemometric equation.

3

1 13. canceled

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1 14. (previously presented) The method of claim 12, further comprising:  
2 correlating the response with known fluid property values.

3

1 15. (previously presented)The method of claim 11, wherein the property is viscosity.

2

1 16. (previously presented)The method of claim 11, wherein the property is density.

2

1 17. (previously presented)The method of claim 11, wherein the property is dielectric  
2 constant.

3

1 18. (previously presented)The method of claim 11, wherein the property is resistivity

2

1 19. (previously presented)The method of claim 12, further comprising:  
2 applying the chemometric estimated parameter value to a Levenberg-Marquardt  
3 (LM) algorithm to determine a fluid parameter value for the fluid.

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1 20. (previously presented)The method of claim 19, wherein the fluid parameter value  
2 comprises a global minimum for the LM algorithm.

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1 21-30 (cancelled)

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1 31. (previously presented ) A system for determining the properties of a downhole  
2 fluid, the system comprising:

- 3 (a) a surface controller that lowers a tool deployed in a well bore  
4 formed in an adjacent formation, the tool interacting with a down hole  
5 fluid;  
6 (b) a resonator in contact with the downhole fluid;  
7 (c) a controller that actuates the resonator; and  
8 (d) a processor that estimates a value of a property for the  
9 downhole fluid using a response of the resonator.

10

1 32. (currently amended) The system of ~~claim 3~~ claim 31,  
2 wherein the processor uses a chemometric equation for estimating a fluid  
3 the property value.

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1 33. (previously presented) The system of claim 32, wherein the processor applies a  
2 function applying the resonator response to a the chemometric equation to  
3 determine a the fluid property value.

4

1 34. (previously presented) The system of claim 31, wherein the processor uses a  
2 function for deriving a chemometric equation from measured resonator response  
3 correlated with known fluid property values.

4

1 35. (previously presented) The system of claim 31, wherein the parameter  
2 value property is viscosity.  
3

1 36. (previously presented) The system of claim 31, wherein the parameter value  
2 property is density.  
3

1 37. (previously presented) The system of claim 31, wherein the parameter value  
2 property is dielectric constant.  
3

1 38. (previously presented) The system of claim 31, wherein the parameter  
2 value property is resistivity.  
3

1 39. (previously presented) The system of claim 12, wherein the processor applies the  
2 chemometric estimated parameter value property to a Levenberg-Marquardt (LM)  
3 algorithm to determine a fluid parameter value for the fluid.  
4

1 40. (previously presented) The system of claim 39, wherein the fluid parameter value  
2 comprises a global minimum for the LM algorithm.  
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1 41. (previously presented) The apparatus of claim 1 wherein the resonator comprises  
2 a mechanical resonator.  
3

1 42. (previously presented) The apparatus of claim 1 wherein the resonator comprises  
2 a tuning fork.  
3

1 43. (new) An apparatus for determining a property of a fluid downhole comprising:  
2 (a) a resonator in direct contact with the fluid downhole;  
3 (b) a controller that actuates the resonator; and  
4 (c) a processor that estimates the property of the fluid using a response of the  
5 resonator to the actuation.  
6